

What is claimed is:

- 1 1. A method for dynamically developing a marketing strategy to address at least one
2 specified merchant objective, the objective corresponding to a specified time period and a
3 specified budget, the strategy being implemented across at least one marketing channel,
4 the strategy including at least one initiative, the method comprising the steps of:
 - 5 a. generating a plurality of marketing strategies;
 - 6 b. determining an optimal marketing strategy based on state of a customer and
7 constraints corresponding to marketing channels;
 - 8 c. deploying the determined optimal marketing strategy;
 - 9 d. recording customer response to the deployed marketing strategy;
 - 10 e. updating information corresponding to the state of a customer based on the
11 recorded customer response; and
 - 12 f. repeating steps b to e for the specified time period.
- 1 2. The method as recited in claim 1 wherein the step of generating marketing strategies
2 comprises the steps of:
 - 3 a. selecting at least one initiative that enables the addressing of the specified
4 objective;
 - 5 b. determining the sequences in which the selected initiatives can be deployed, if
6 more than one initiative is selected; and
 - 7 c. combining the initiatives in the determined sequences to obtain the plurality of
8 marketing strategies.
- 1 3. The method as recited in claim 2 further comprising the step of varying the parameters of
2 initiatives to generate new initiatives.
- 1 4. The method as recited in claim 2 further comprising the step of varying deployment time
2 of initiatives.
- 1 5. The method as recited in claim 1 wherein the step of determining an optimal marketing
2 strategy further comprises the steps of:
 - 3 a. determining all possible states of customers;

- b. determining an optimal policy for each state based on past data;
- c. identifying the state of a customer, the customer visiting the merchant or the customer being selected from a database of customers; and
- d. identifying an optimal marketing strategy using the state of the customer, the identified optimal policy and constraints corresponding to marketing channels.

6. The method as recited in claim 5 wherein the step of identifying all possible states of customers comprises the steps of:

- a. identifying all relevant attributes of customers; and
- b. partitioning the customers based on the identified attributes using a similarity measure based on a historic policy, actual rewards and transition probabilities from one data point to another, the partitions forming the new states of the customers.

7. The method as recited in claim 5 wherein the step of determining the optimal policy for each state based on past data comprises the steps of:

- a. identifying a deterministic policy;
- b. initializing the value of all possible states for the policy;
- c. computing the value of a state for the policy;
- d. repeating step c for all possible states;
- e. constructing a new improved policy;
- f. iteratively performing steps c to e until the new improved policy remains unchanged for two subsequent iterations; and
- g. selecting the policy with maximum value for the state as the optimal policy for the given state.

8. The method as recited in claim 7 wherein the step of computing the value of a state for the policy comprises the steps of:

- a. computing transition probabilities from the given state to another state for the policy;
- b. computing value of expected immediate reward for the policy in the state;
- c. computing discounted expected value of the resulting state for the policy; and

7 d. computing the sum of expected immediate reward and the discounted expected
8 value.

1 9. The method as recited in claim 7 wherein the step of constructing a new improved policy
2 comprises the steps of:

3 a. selecting the marketing strategy which maximizes the value for the state over all
4 marketing strategies for a given state; and

5 b. repeating step a for each state.

1 10. The method as recited in claim 5 wherein the step of identifying an optimal marketing
2 strategy comprises the steps of:

3 a. identifying the optimal policy for the identified customer state;

4 b. modeling customer's preferences for marketing channels, cost and effectiveness of
5 different marketing channels, and the specified budget as effective constraints;

6 c. determining an optimal feasible policy based on the identified optimal policy and
7 the effective constraints corresponding to marketing channels; and

8 d. determining the optimal marketing strategy from the optimal feasible policy.

1 11. The method as recited in claim 10 wherein the step of determining an optimal feasible
2 policy based on effective constraints corresponding to marketing channels comprises the
3 step of mapping the optimal policy uniquely to a closest feasible optimal policy based on
4 the effective constraints, if the constraints are not satisfied by the optimal policy.

1 12. The method as recited in claim 1 wherein the step of updating information corresponding
2 to the state of a customer based on the recorded customer response comprises the steps of:

3 a. identifying the resulting state of the customer;

4 b. updating the values of the states of the customer; and

5 c. updating the optimal policy.

1 13. The method as recited in claim 12 wherein the step of updating the values of the states of
2 the customer comprises the steps of:

- a. computing the sum of the new immediate reward, the discounted value corresponding to the resulting state, reduced by the value corresponding to the initial state of the customer;
- b. updating the value corresponding to the initial state of the customer by adding a fraction of the computed sum to value of previous state of customer; and
- c. propagating the change in the value of the state to all other states.

14. The method as recited in claim 12 wherein the step of updating the optimal policy comprises the steps of:

- a. computing the sum of the new immediate reward, the discounted value corresponding to the resulting state, reduced by the value corresponding to the initial state of the customer; and
- b. updating the optimal policy corresponding to the initial state of the customer by adding a fraction of the computed sum to the value of previous state of customer.

15. A system for dynamically developing a marketing strategy to address at least one specified merchant objective, the objective corresponding to a specified time period and a specified budget, the strategy being implemented across at least one marketing channel, the strategy including at least one initiative, the system comprising:

- a. means for generating a plurality of marketing strategies;
- b. means for determining an optimal marketing strategy based on state of a customer and constraints corresponding to marketing channels;
- c. means for deploying the determined optimal marketing strategy;
- d. means for recording customer response to the deployed marketing strategy; and
- e. means for updating information corresponding to the state of a customer based on the recorded customer response.

16. The system as recited in claim 15 wherein the means for generating marketing strategies comprises:

- a. means for selecting at least one initiative that enables the addressing of the specified objective;
- b. means for determining the sequences in which the selected initiatives can be deployed, if more than one initiative is selected; and

- 7 c. means for combining the initiatives in the determined sequences to obtain the
8 plurality of marketing strategies.

1 17. The system as recited in claim 15 wherein the means for determining an optimal
2 marketing strategy comprises:

- 3 a. means for determining all possible states of customers;
4 b. means for determining an optimal policy for each state based on past data;
5 c. means for identifying the state of a customer, the customer visiting the merchant
6 or the customer being selected from a database of customers;
7 d. means for identifying the optimal policy for the identified customer state;
8 e. means for modeling customer's preferences for marketing channels, cost and
9 effectiveness of different marketing channels, and the specified budget as effective
10 constraints;
11 f. means for determining an optimal feasible policy based on effective constraints
12 corresponding to marketing channels; and
13 g. means for determining the optimal marketing strategy from the optimal feasible
14 policy.

1 18. The system as recited in claim 17 wherein the means for determining the optimal policy
2 for each state based on past data comprises:

- 3 a. means for identifying a deterministic policy;
4 b. means for initializing the value of all possible states for the policy;
5 c. means for computing the value of a state for the policy;
6 d. means for constructing a new improved policy;
7 e. means for iteratively executing means for computing and means for constructing;
8 and
9 f. means for selecting the policy with maximum value for the state as the optimal
10 policy for the given state.

1 19. The system as recited in claim 18 wherein the means for constructing a new improved
2 policy comprises means for selecting the marketing strategy that maximizes the value for
3 the state over all marketing strategies for a given state.

1 20. The system as recited in claim 15 wherein the means for updating information
2 corresponding to the state of a customer based on the recorded customer response
3 comprises:

- 4 a. means for identifying the resulting state of the customer;
- 5 b. means for updating the values of the states of the customer; and
- 6 c. means for updating the optimal policy.

1 21. A computer program product for dynamically developing a marketing strategy to address
2 at least one specified merchant objective, the objective corresponding to a specified time
3 period and a specified budget, the strategy being implemented across at least one
4 marketing channel, the strategy including at least one initiative, the computer program
5 product comprising:

- 6 a. program instruction means for generating a plurality of marketing strategies;
- 7 b. program instruction means for determining an optimal marketing strategy based on
8 state of a customer and constraints corresponding to marketing channels;
- 9 c. program instruction means for deploying the determined optimal marketing
10 strategy;
- 11 d. program instruction means for recording customer response to the deployed
12 marketing strategy; and
- 13 e. program instruction means for updating information corresponding to the state of a
14 customer based on the recorded customer response.

1 22. The computer program product as recited in claim 21 wherein the program instruction
2 means for generating marketing strategies comprises:

- 3 a. program instruction means for selecting at least one initiative that enables the
4 addressing of the specified objective;
- 5 b. program instruction means for determining the sequences in which the selected
6 initiatives can be deployed, if more than one initiative is selected; and
- 7 c. program instruction means for combining the initiatives in the determined
8 sequences to obtain the plurality of marketing strategies.

1 23. The computer program product as recited in claim 21 wherein the program instruction
2 means for determining an optimal marketing strategy comprises:

- 3 a. program instruction means for determining all possible states of customers;
- 4 b. program instruction means for determining an optimal policy for each state based
5 on past data;
- 6 c. program instruction means for identifying the state of a customer, the customer
7 visiting the merchant or the customer being selected from a database of customers;
- 8 d. program instruction means for identifying the optimal policy for the identified
9 customer state;
- 10 e. program instruction means for modeling customer's preferences for marketing
11 channels, cost and effectiveness of different marketing channels, and the specified
12 budget as effective constraints;
- 13 f. program instruction means for determining an optimal feasible policy based on
14 effective constraints corresponding to marketing channels; and
- 15 g. program instruction means for determining the optimal marketing strategy from
16 the optimal feasible policy.

1 24. The computer program product as recited in claim 23 wherein the program instruction
2 means for determining the optimal policy for each state based on past data comprises:

- 3 a. program instruction means for identifying a deterministic policy;
- 4 b. program instruction means for initializing the value of all possible states for the
5 policy;
- 6 c. program instruction means for computing the value of a state for the policy;
- 7 d. program instruction means for constructing a new improved policy;
- 8 e. program instruction means for iteratively executing means for computing and
9 means for constructing; and
- 10 f. program instruction means for selecting the policy with maximum value for the
11 state as the optimal policy for the given state.

1 25. The computer program product as recited in claim 24 wherein the program instruction
2 means for constructing a new improved policy comprises program instruction means for

3 selecting the marketing strategy that maximizes the value for the state over all marketing
4 strategies for a given state.

1 26. The computer program product as recited in claim 21 wherein the program instruction
2 means for updating information corresponding to the state of a customer based on the
3 recorded customer response comprises:

- 4 a. program instruction means for identifying the resulting state of the customer;
- 5 b. program instruction means for updating the values of the states of the customer;
- 6 and
- 7 c. program instruction means for updating the optimal policy.

1 27. A system suitable for developing an optimal marketing strategy, the system comprising:

- 2 a. a database storing information regarding initiatives that can be offered to
- 3 customers, marketing channels available for executing the initiatives, cost and
- 4 effectiveness of the marketing channels, and states of customers;
- 5 b. means for enabling the merchant to specify at least one objective for a specified
- 6 time period;
- 7 c. means for generating a plurality of marketing strategies based on the objective
- 8 specified by the merchant, the marketing strategies being a combination of
- 9 initiatives; and
- 10 d. means for determining the optimal marketing strategy and the corresponding at
- 11 least one marketing channel based on state of the customer and cost and
- 12 effectiveness of marketing channels.

1 28. A method for dynamically developing a marketing strategy to address at least one
2 specified merchant objective, the objective corresponding to a specified time period and a
3 specified budget, the strategy being implemented across at least one marketing channel,
4 the strategy including at least one initiative, the method comprising the steps of:

- 5 a. generating a plurality of marketing strategies;
- 6 b. determining all possible states of customers;
- 7 c. determining an optimal policy for each state based on past data;
- 8 d. identifying the state of a customer, the customer visiting the merchant or the
- 9 customer being selected from a database of customers;

- 10 e. identifying the optimal policy for the identified customer state;
- 11 f. modeling customer's preferences for marketing channels, cost and effectiveness of
- 12 different marketing channels, and the specified budget as effective constraints;
- 13 g. determining an optimal feasible policy based on the identified optimal policy and
- 14 the effective constraints corresponding to marketing channels;
- 15 h. determining an optimal marketing strategy from the optimal feasible policy;
- 16 i. deploying the determined optimal marketing strategy;
- 17 j. recording customer response to the deployed marketing strategy;
- 18 k. identifying the resulting state of the customer;
- 19 l. updating the values of the states of the customer;
- 20 m. updating the optimal policy; and
- 21 n. repeating steps c to m for the specified time period.